Project Introduction

Current technology for decelerating a spacecraft from the high speed of atmospheric entry to the final stages of landing on Mars is based on parachute systems. It dates back to NASA's Viking Program. In order to enable future exploration missions featuring sophisticated robots and safely land heavier spacecraft on Mars, this technology must be advanced to a new level of performance at supersonic speeds. For this purpose, larger than before high-speed parachutes and inflatable drag devices are needed. For a number of reasons ranging from cost to technical considerations, the design, development, and maturing of such devices for future use at Mars cannot be performed by relying only on tests. These tasks need assistance from predictive simulations based on a high-fidelity, multi-disciplinary computational model for parachute inflation dynamics and drag prediction. The development of such a model is a formidable challenge, as this model must be able to predict various instabilities of a parachute such as flutter and pulsation which can be encountered in the supersonic regime, and assess the influence on its performance of several factors such as material and geometric porosities, the relative size of its forebody with respect to its diameter, its distance from the forebody, the shape of the forebody, the line length, canopy design, and the Mach number. It must also be able to predict the influence of temperature and strain rate on the stress field a parachute can experience in the supersonic regime. In short, the development of such a computational model requires a number of innovations whose development constitutes the objective of the proposed effort. The expected outcome of this effort is a state-of-the-art modeling and simulation capability that will improve the design and performance of supersonic parachutes for Mars landing and save costs by reducing testing.

Anticipated Benefits

This project could produce a state-of-the-art modeling and simulation capability that will improve the design and performance of supersonic parachutes for Mars landing and save costs by reducing testing.

An Innovative High Fidelity Multidisciplinary Computational Framework for Parachute Inflation Dynamics
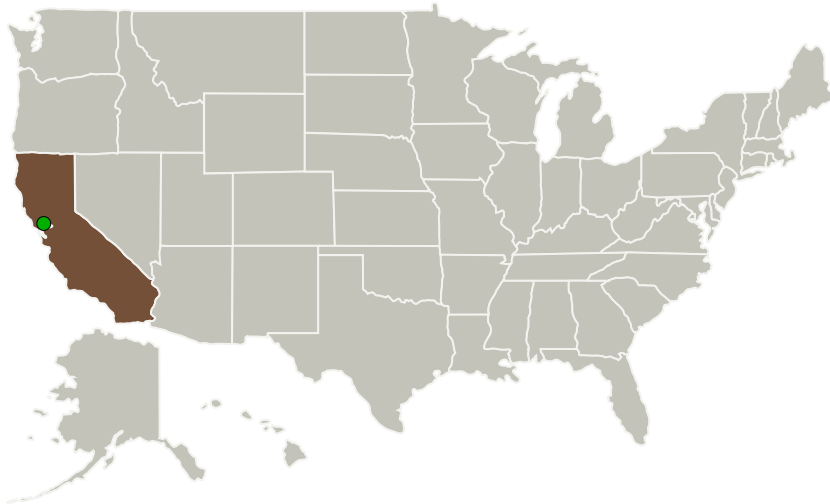
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An Innovative High Fidelity Multidisciplinary Computational Framework for Parachute Inflation Dynamics

Completed Technology Project (2017 - 2020)

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
Stanford University(Stanford)	Lead Organization	Academia	Stanford, California
🟢 Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Stanford University (Stanford)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:
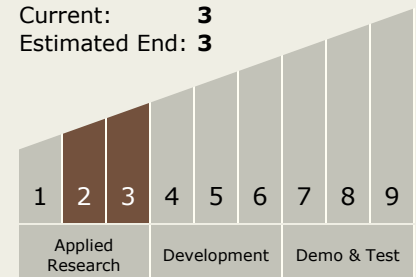
Hung D Nguyen

Principal Investigator:

Charbel Farhat

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**

Technology Areas

Primary:

- TX09 Entry, Descent, and
  Landing
  └ TX09.2 Descent
     └ TX09.2.1 Aerodynamic
        Decelerators

Target Destination
Outside the Solar System